WORCESTER FREE INSTITUTE.

MANUFACTURES

OF THE

WASHBURN MACHINE SHOP.

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AT THE

WASHBURN MACHINE SHOP,

CONNECTED WITH THE WORCESTER FREE INSTITUTE, ARE MANUFACTURED FOR SALE

MACHINISTS' TOOLS,

Engine and Speed Lathes, with Hardened Steel Bearings, Revolving Head Screw Machines, Hardened Steel Mandrils, Chuck Drills, Bench Centres and Lathe Dogs.

EMERY GRINDING MACHINERY

OF EVERY DESCRIPTION.

All Sizes of Machines for running Solid Wheels—of Improved Design and Superior Construction—Planer Knife Grinders and Saw Gummers.

HYDRAULIC ELEVATORS,

AND GENERAL HYDRAULIC MACHINERY.

WOOD WORK

Pattern Making, Scroll Sawing, Wood Turning, Builder's Finish and Brackets.

SCHOOL APPARATUS

Drawing Models, The Improved Adjustable Drawing Tables, Drawing Boards and T Squares.

ALL THE IRON AND WOODEN

APPARATUS FOR CHEMICAL LABORATORIES.

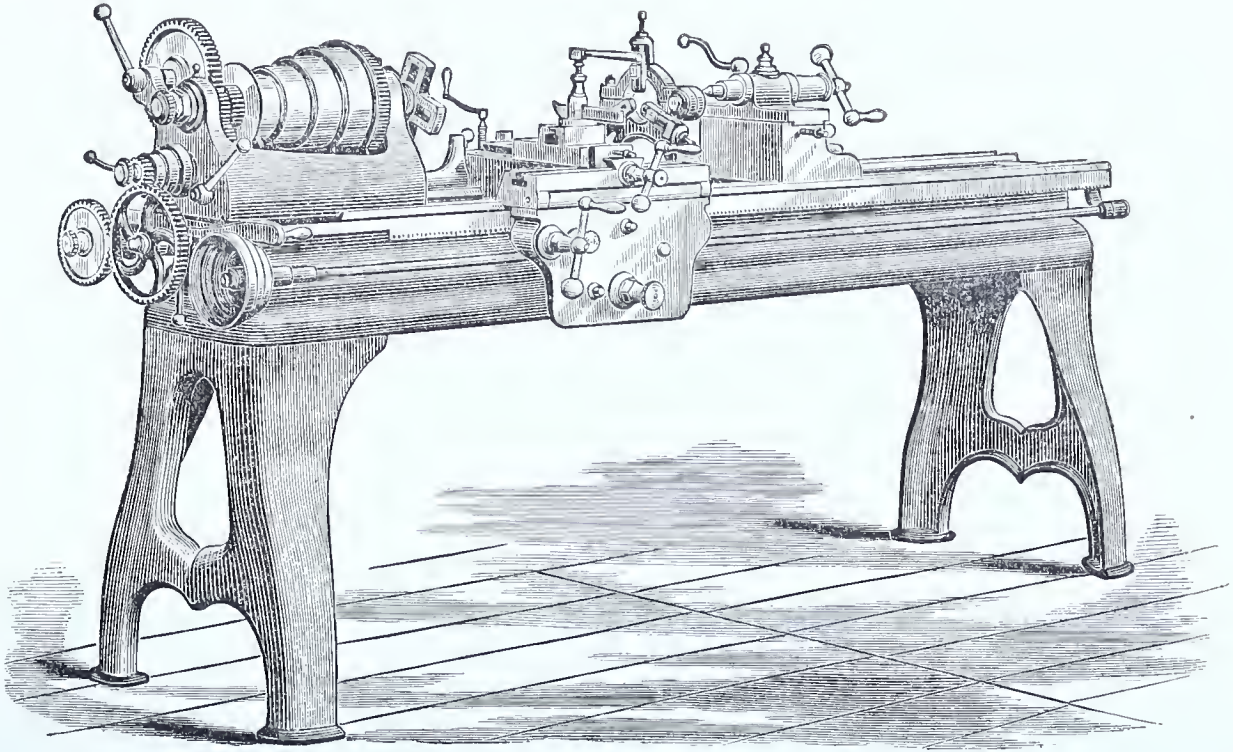
Lamp Stands, Concentric Ring Stands, Test Tube Racks, Pepy's Gasometers.

APPARATUS FOR PHYSICAL LABORATORIES.

Including the Willis System of Apparatus for the use of Lecturers and Experimenters in Mechanical Philosophy, Complete Working Machines illustrating the movements of the Link and Valve, C. H. Morgan's Machine showing the correct forms for Cams and their Movements.

BEST FACILITIES FOR DOING FIRST-CLASS MACHINE WORK.

ALL WORK MADE TO THE WHITWORTH STANDARD GAUGES.



16-INCH LATHE,

WITH HARDENED STEEL BEARINGS.

PLAN OF THE SHOP.

The plan of operations in the Shop is to make its products of the best kind, in design, material and workmanship.

The equipment consists of the machinery and tools, which the experience of the leading manufacturers of the country has proved to be the best adapted to the production of the better class of work. Our designs for Machinery have been made with reference to the following principles: 1st., Accuracy; 2nd., Durability and Simplicity; 3d., Convenience of Operation; 4th., Economy.

To secure the first, special care is taken to keep the tools in the best working condition. The work is done by the most improved methods, and the most important parts by the best workmen, while all is under the supervision of experienced mechanics.

Durability is secured by using the best material in forms which secure the greatest possible strength.

Appropriate and graceful forms are considered desirable, but no unnecessary labor is bestowed on exterior ornamentation or finish.

The cut on the opposite page represents the **16-Inch Engine Lathe.**

This Lathe, with 8 feet bed, complete, weighs about 1,500 lbs., and is designed to excel in every feature.

The Spindle is made of hardened cast steel, finished after it is hardened. The danger of springing is thus avoided, and the bearing portions are sure to be left perfectly *round, smooth* and *hard.*

The Box is made of a solid piece, ground to an exact form after being hardened.

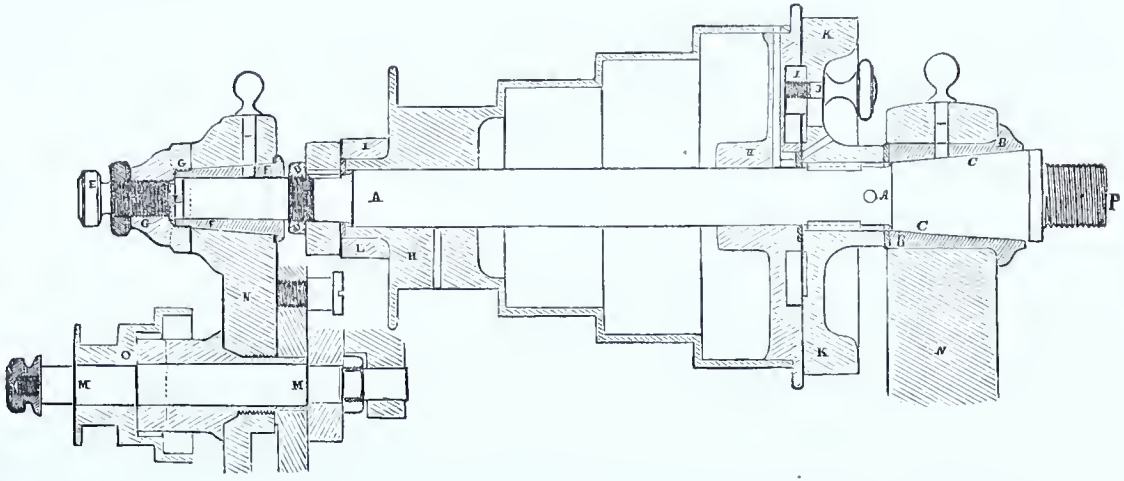
The Bearings are larger and longer than is customary, and conical shape, which enables them to be kept to an exact running fit without destroying the circular form of the box, as is the case when the box is put together in halves in the old way.

The Tail Stock stands on a broad base, and is held rigidly in position by a single turn with the right hand, without a wrench.

The Belt Cone and **Back Gearing** are made broad and strong.

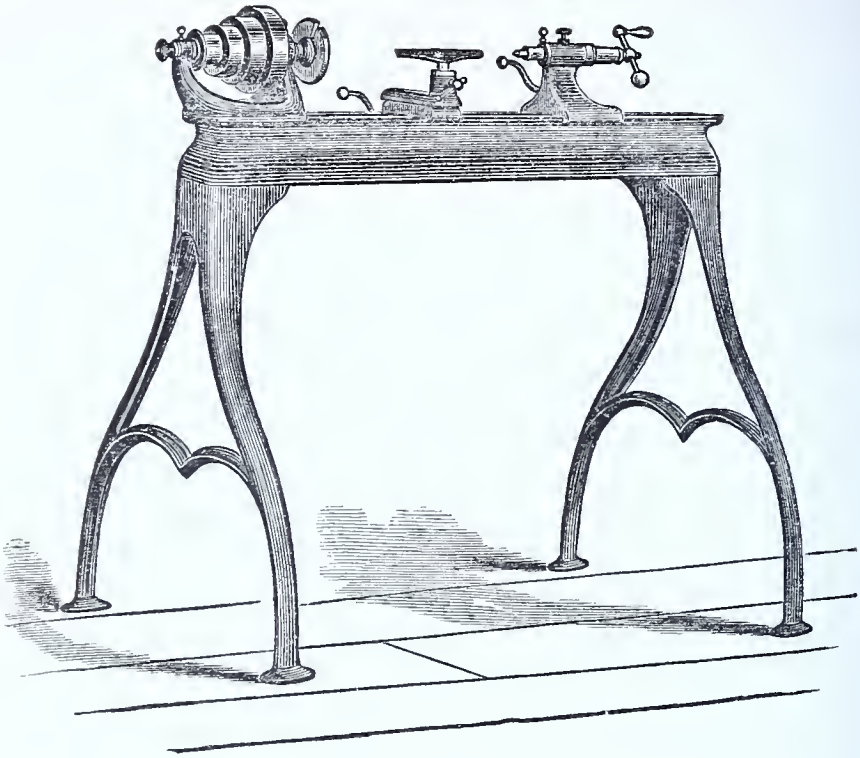
The combination of the above points, with accurate workmanship, renders this Lathe particularly adapted for doing the nicest jobs, and at the same time the most durable for the roughest work.

The following description and cut of the Engine Lathe are taken from Johnson's Cyclopedia, Vol. 2; Article, "*Lathe*," written by Prof. R. H. Thurston :—



SECTION OF HEADSTOCK OF ENGINE LATHE.

"The finest fitting and the best workmanship are expended upon the headstock of the Lathe. Fig. 4 is a sectional drawing of this part of the tool, as made at the Free Institute of Industrial Science, at Worcester, Mass. It represents the best of practice. It is 8 feet in length, 'swings,' *i. e.*, it can turn a piece of the diameter of 16 inches, and weighs 1,500 pounds. The spindle *A*, *A*, is of hardened cast steel, ground perfectly cylindrical, *after having been hardened*, to avoid danger of change of form in the process of hardening, to secure absolute truth in size and shape, and to obtain perfect smoothness and the desired hardness. The box, *B*, carrying this spindle, is subjected to all the strain thrown upon the latter, whether by the weight of the piece or by the force exerted by the tool. Here it is made of a single piece of steel, fitted approximately to finished size, hardened, and finally ground to exact form and to fit. The spindle bearing, *C*, *C*, where it turns in the box, is conical, and capable of adjustment longitudinally, to take up the looseness occasioned by the wear, which takes place even with hardened steel journals running in hardened steel bearings. End-play is prevented by the nut, *D*, *D*, and the set screw, *E*, *E*, which hold the spindle snugly in a position such that it may turn freely without either side or end-play. The back end of the spindle is carried in the journal, *F*, its box being held by the cap-screw, *G*, *G*. The cone-pulley, *H*, *H*, turns loosely on the spindle when the back-gear is in action, and is clamped by the sliding-block, *I*, and screw, *J*, when the spindle and the cone are to move together, the cone driving the gear, *K*, *K*, directly, and the latter carrying the spindle, to which it is secured by keys. The pinion, *L*, *L*, on the cone-pulley, drives the back-gear. A spindle, *M*, *M*, carried on the rear plate of the head-stock, *N*, *N*, carries the feed-cone pulley, *O*. The belt-cone, *H*, *H*, and the back-gearing are given broad bearings."



THE SPEED LATHE,

9 INCH SWING, 4 FEET BED.

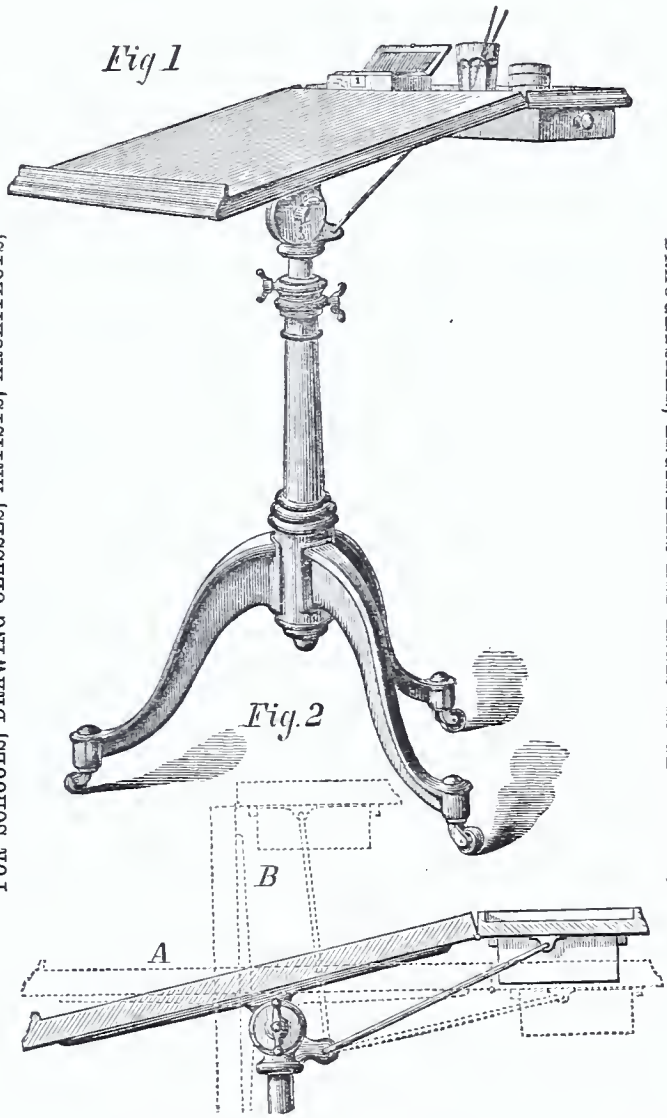
Is made in the same thorough manner as the Engine Lathe, with hardened spindles running in conical shaped bearings. This plan ensures great beauty, and smoothness in running at high speed.

The attachment for foot power and the Slide Rest are furnished with these Lathes if desired. Also, a Fixture for Screw Cutting and Gear Cutting for small work. Workmanship warranted.

THE PATENT

ADJUSTABLE STAND.

FOR SCHOOLS, DRAWING-CLASSES, ARTISTS, ARCHITECTS,



DRAUGHTSMEN, ENGINEERS AND ARTISANS GENERALLY.

PATENTED NOVEMBER 19, 1872.

THIS

IMPROVED ADJUSTABLE STAND

IS SUBSTANTIAL,

ORNAMENTAL, CONVENIENT AND CHEAP,

AND ITS TASTEFUL APPEARANCE MAKES IT

SUITABLE FOR THE OFFICE, LIBRARY OR SITTING-ROOM.

It can be fixed at any *required height*, so one can use it either sitting or standing; and by turning back the screw at the right, it is allowed to rotate, bringing *either side in front*. The shelf or ledge for instruments is attached to the back side of the table, so that it is *always level*, whatever inclination is given to the desk. This is very convenient for the water-cups, ink-stands, etc. Fig. 2 shows the table fixed at a slight inclination, the dotted lines showing it horizontal at *A* or vertical at *B*. When the table is nearly vertical the whole occupies but little space, and forms a perfect easel. When used for this purpose a neat attachment, not shown in the cut, is furnished for holding the picture, and the adjustments are so simple that a mere touch is sufficient to *effect an entire change in the light which falls upon the work.*

Under the instrument shelf, are provided two drawers for working materials. The table and drawers are made of black walnut or other appropriate wood, nicely finished.

The tripod, hollow standard and sliding spindle are of cast iron, neatly painted and bronzed. The working parts are well finished and are very easily operated. The Stand complete weighs 55 pounds, and is sufficiently firm to support a drawing-board 44 inches square, without inconvenience. In the lowest position the table is 30 inches high, and may be elevated to 44 inches.

PRICE LIST.

No. 1.	Suitable for School-rooms, Shops, etc., plain soft wood top, as shown in the Figure, 22x24 inches, ...	$8 00
No. 2.	Same as No. 1, with Instrument Shelf, 7 x 9 inches, ...	9 00
No. 3.	Black Walnut Top, 22 x 26 inches; Instrument Shelf, 7 x 26, ...	10 00
No. 4.	Suitable for Counting-rooms, Architects' offices, etc., black walnut top, 22 x 26 inches; Instrument Shelf, 7 x 26 inches; two Instrument Drawers, mounted on castors, bronze paint, ...	12 00
No. 5.	Same as No. 4, selected walnut top, polished, castings bronzed and ornamented; suitable for home use, ...	15 00
No. 6.	Engraving Stand, ...	20 00

Liberal Discounts when ordered in numbers, for Schools, etc.

AMERICAN DRAWING MODELS,

FOR

Common Schools, Drawing Classes and Schools of Art and Science.

DESIGNED BY

WALTER SMITH, Art Master.

Professor of Art Education in the City of Boston Normal Art School, and State Director of Art Education for the State of Massachusetts.

TRADE **MARK.**

Secured under U. S. Patent Law, July 16, 1872.

The increasing demand for *Art Education*, and its general adoption as a branch of common school instruction, by the Legislature of Massachusetts, has rendered it necessary that a supply of proper models with which to convey this instruction should be produced. Designs have been obtained from Mr. Walter Smith, Director of Art Education for the State of Massachusetts, from which we are now prepared to furnish complete sets of models. These are made from the best materials in a thorough manner; and by having extensively fitted up special machinery, the work is produced with accuracy at a much less price than would be possible otherwise. Each model being made to dimensions, these sets are equally suited to all kinds of Free-Hand, Instrumental and Perspective Drawing.

SET No. 1 consists of the following pieces:

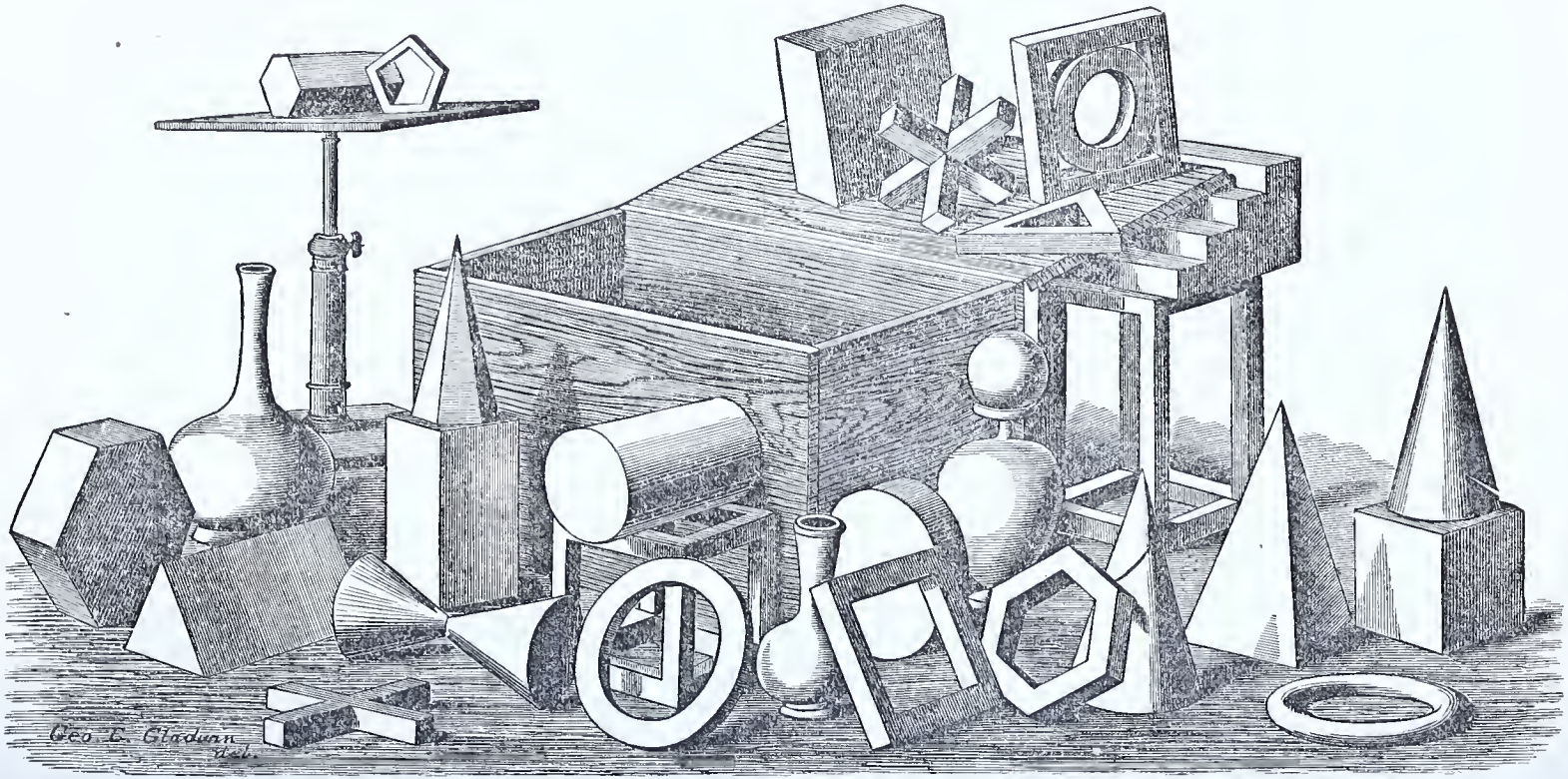
1. *Sphere.* Four inches diameter.
2. *Cone.* Base four inches diameter, altitude eight inches.
3. *Cylinder.* Base four inches, altitude eight inches.
4. *Cone, in Sections.* Base four inches, altitude eight inches.
5. *Cube.* Side four inches.
6. *Oblong Block.* Four inches square, length eight inches.
7. *Triangular Prism.* Side of base four inches, length of prism eight inches, base equilateral.
8. *Hexagonal Prism.* Diagonal of base four inches, length of prism eight inches, base regular.
9. *Rectangular Pyramid.* Side of base four inches, altitude eight inches.
10. *Hexagonal Pyramid.* Diagonal of base four inches, altitude of pyramid eight inches.
11. *Square Block.* Six inches square, two inches thick.
12. *Disk.* Six inches diameter, two inches thick.
13. *Flight of four Steps.* One inch rise, one and one-half inches tread, width six inches.
14. *Double Cone.* Altitude eight inches, diameter at junction of cones one inch, bases of cones four inches.
15. *Cross.* Six inches, made of seven-eighths inch stuff.
16. *Triangular Frame.* Equilateral Triangle of six inches side, seven-eighths inch stuff.
17. *Square Frame.* Six inches square, seven-eighths stuff.
18. *Pentagonal Frame.* Outer Pentagon inscribed in a circle of six inches, seven-eighths inch stuff.
19. *Hexagonal Frame.* Side of three inches, seven-eighths inch stuff.
20. *Circular Frame.* Square in section, six inches diameter, seven-eighths inch stuff.
21. *Circular Ring.* Circular in section, six inches diameter.
22. *Double Cross.* Six inches, seven-eighths inch stuff.
23. *Skeleton Cube.* Six inches side, seven-eighths inch stuff.
24. *Oblong Frame.* Twelve inches long, six inches square, seven-eighths inch stuff.
25. *Square Frame and Ring.* Six inches square, seven-eighths inch stuff. Circle inscribed.
26. *Hexagonal Disk.* Two inches thick, six inches diagonal.
27, 28, 29. *Three Selected Vases.*
30. *Adjustable Model Stand.* Top and bottom eleven and one-half inches square.

SET No. 2.—A box containing ten Wooden Vases, duplicated from the Greek or ginals.

SET No. 3.—Four Large Models for lectures and instruction to classes: 1. Cube, fifteen inches side. 2. Cone, with base twelve inches, altitude eighteen inches. 3. Cylinder, base twelve inches, altitude eighteen inches. 4. Hexagonal Prism, base twelve inches, length twenty-four inches. Price Lists sent upon application.

Letters concerning the business of the shop should be addressed

M. P. HIGGINS, Supt., WORCESTER, MASS.



Representation of Set No. 1.